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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/625,007	07/23/2003	Kyoung-woo Lee	SAM-0313CIP	8434

7590 06/02/2005
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EXAMINER

NGUYEN, HA T

ART UNIT PAPER NUMBER

2812

DATE MAILED: 06/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/625,007

Applicant(s)

LEE ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-52 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 5-21,3-1,1-20-4,4-28-5
- 4) ☒ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION***Claim Objections***

1. Claim 19 is objected to because of the following informalities: in line 1, after “HF” substitution of “,” with –or – is suggested for correctness. Appropriate correction is required.

Claim Rejections - 35 USC, § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(a) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-10, 16, 18-21, 23-28, 34, and 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu et al. (USPN 6461955, hereinafter “Tsu”) in view of Aoi (USPN 6387824).

Referring to Figs. 2A-2G and related text, Tsu discloses [Re claim 1] a method of fabricating dual damascene interconnections, the method comprising: (a) forming on a substrate 100 a hybrid dielectric layer 106, 108; (b) forming a via 112 in the dielectric layer; (c) filling the via with a carbon-free inorganic filler 114; (d) partially etching the inorganic filler filling the via and the dielectric layer to form a trench, which is connected to the via and in which interconnections will be formed (see Fig. 2E); (e) removing the inorganic filler remaining in the

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via; and (f) completing interconnections by filling the trench and the via with interconnection material (See Fee 2F-2G); [Re claims 2, 4-5, 10, and 21-23] a method of fabricating dual damascene interconnections, the method comprising: (a) forming an organo silicate glass layer on a substrate; (b) forming a via in the organo silicate glass layer; (c) filling the via with an HSQ-based filler (see col. 3, lines 29-39); (d) partially etching the HSQ -based filler filling the via and the organo silicate glass layer to form a trench, which is connected to the via and in which interconnections will be formed; (e) removing the HSQ -based filler remaining in the via; and (f) completing interconnections by filling the trench and the via with an interconnection material, as shown above. But it fails to disclose expressly the use of a hybrid dielectric, an organo silicate glass and the value of its dielectric constant, the etching of the filler using HF and the use of CVD to deposit the hybrid dielectric . However, the missing limitations are well known in the art because Aoi discloses these features (See embodiment 3). Besides HF is well known to be used for etching silicon oxide based material. A person of ordinary skill is motivated to modify Tsu with Aoi to obtain device of low capacitance.

[Re claims 3, 6-8, and 24-27] Tsu also discloses wherein the etch stop layer is formed of at least one of SiC, SiN, and SiCN; before step (b), forming a capping layer on the hybrid dielectric layer having a dielectric constant of 3.3 or less; wherein in step (b), a via is formed in the capping layer and the dielectric layer; wherein the capping layer is formed of an anti-reflective material; wherein the capping layer is formed of at least one of SiO₂, SiOF, SiON, SiC, SiN and SiCN (see Figs. 2A-2C and col. 2, line 45-col. 3, line 14); [Re claims 16 and 34] wherein step (d) includes: forming a photoresist pattern 120 on the inorganic filler to define the trench; forming the trench by dry etching using the photoresist pattern as an etch mask such that an etch ratio of the inorganic filler to the dielectric layer is 4:1 or lower; and removing the photoresist pattern; [Re claims 18 and 36] wherein step (e) comprises wet etching such that an etch ratio of the inorganic filler to the dielectric layer is 20:1 or higher. (see Fig. 2D-2E and col. 3, lines 29-38) [Re claims 20 and 38] wherein in step (f), the interconnection is a copper interconnection (see col. 4, lines 13-17) .

[Re claims 9 and 28] Aoi also discloses forming a photoresist pattern on the dielectric layer to define the via; and forming the via exposing the etch stop layer by dry etching the dielectric layer using the photoresist pattern as an etch mask (see Fig. 3(b)).

Therefore, at the time of the invention, it would have been obvious to combine Tsu with Aoi to obtain the invention as specified in claims 1-10, 16, 21, 23-28, 34, 36, and 38.

4. Claims 17 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable Tsu in view of Aoi, as applied above, and further in view of Robinson et al. (USPN 4201579, hereinafter "Robinson").

The combined teaching of Tsu and Aoi discloses substantially the limitations of claims 17 and 35, as shown above.

But it fails to disclose expressly wherein the dry etching uses CxFy or CxHyFz as a main etching gas, and removing the photoresist pattern uses an H2-based plasma..

However, the missing limitation is well known in the art because Robinson discloses the use of H2 plasma to remove photoresist (See col. , lines). Besides, the examiner takes Official Notice that CxFy or CxHyFz is conventional dry etchant for silicon oxide-based material.

A person of ordinary skill is motivated to modify Tsu and Aoi with Robinson to obtain clean device with no undesirable oxidation.

Therefore, at the time of the invention, it would have been obvious to combine Tsu and Aoi with Robinson to obtain the invention as specified in claims 17 and 35.

5. Claims 11-12, 14-15, 29-30, and 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu or Aoi, as applied above in view of Lui (USPN 6391761).

Tsu or Aoi discloses substantially the limitations of claims 12, 14-15, 30, and 32-33, as shown above.

But it fails to disclose expressly the use of an organic antireflective layer under a photoresist layer.

However, these are well known in the art because Lui discloses the use of an organic antireflective layer 85 (See par. bridging cols. 4-5). The combined teaching of Tsu or Aoi and Lui does not disclose the thickness of the antireflective layer or the inclusion in the filler of a light absorption material and/or a dissolution inhibitor for a photoresist developing solution . However, it would have been obvious for an ordinary artisan to select an appropriate thickness to

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effectively achieve the desired objective and to include in the filler a dissolution inhibitor for a photoresist developing solution to prevent damage of the filler when the photoresist is developed.

A person of ordinary skill is motivated to modify Tsu or Aoi with Lui to obtain better resolution.

Therefore, at the time of the invention, it would have been obvious to combine Tsu or Aoi with Lui to obtain the invention as specified in claims 11-12, 14-15, 29-30, and 32-33.

6. Claims 13, 31, and 39-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsu or Aoi in view of Lui, as applied above, and further in view of Lee et al. (USPN 6171951, hereinafter "Lee").

The combined teaching of Tsu or Aoi and Lui discloses substantially the limitations of claims 13, 31, and 39-52, as shown above.

But it fails to disclose expressly plasma treating the filler and the details about the plasma.

However, the missing limitations are well known in the art because Lee discloses these features (See col. 3, lines 24-36).

A person of ordinary skill is motivated to modify Tsu or Aoi and Lui with Lee to obtain better stability.

[Re claim 39] Arguments used for the rejections of claims 21-23 and 29 also apply.

[Re claims 40-52] Arguments used for the rejections of claims 24-29 and 31-38, respectively also apply

Therefore, at the time of the invention, it would have been obvious to combine Tsu or Aoi and Lui with Lee to obtain the invention as specified in claims 13, 31, and 39-52.

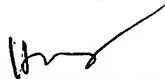
Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



**HANGUYEN
PRIMARY EXAMINER**

5- 27 - 05